10th Class 2015

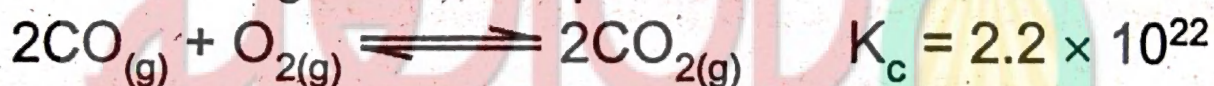
Chemistry	Group-I	Paper-II
Time: 2.45 Hours	(Subjective Type)	Marks: 63

(Part-I)

2. Write short answers to any Five (5) questions: 10

(i) How does large numerical value of K_c help us to predict the extent of a chemical reaction?

Ans The large numerical value of K_c indicates that at equilibrium position, the reaction mixture consists of almost all products and reactants are negligible. The reaction has almost gone to completion. For example, oxidation of carbon monoxide goes to completion at 1000 K.

$$2CO_{(g)} + O_{2(g)} \rightleftharpoons 2CO_{2(g)} \qquad K_c = 2.2 \times 10^{22}$$

(ii) Write any two macroscopic characteristics of dynamic equilibrium.

Ans 1. An equilibrium is achievable only in a closed system (in which substances can neither leave nor enter).

2. At equilibrium state, a reaction does not stop. Forward and reverse reactions keep on taking place at the same rate but in opposite direction.

(iii) Write any two characteristic properties of bases.

Ans 1. Bases have bitter taste and feel slippery, *e.g.*, soap is slippery to touch.

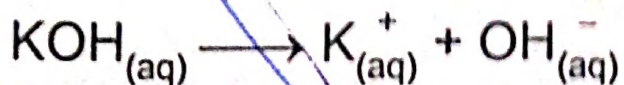
2. They turn red litmus blue.

(iv) Write sources of Citric acid and Lactic acid.

Ans Citric acid comes from citrus fruits, *i.e.*, lemon, orange etc. and the source of lactic acid is sour milk.

(v) Find out the pOH of 0.001 M solution of KOH.

Ans Potassium hydroxide solution is a strong base. It ionizes completely such that one mole of KOH gives one mole of OH^- ions.

$$KOH_{(aq)} \longrightarrow K^+_{(aq)} + OH^-_{(aq)}$$

Therefore, 0.001 M solution of KOH produces 0.001 M OH^- ions.

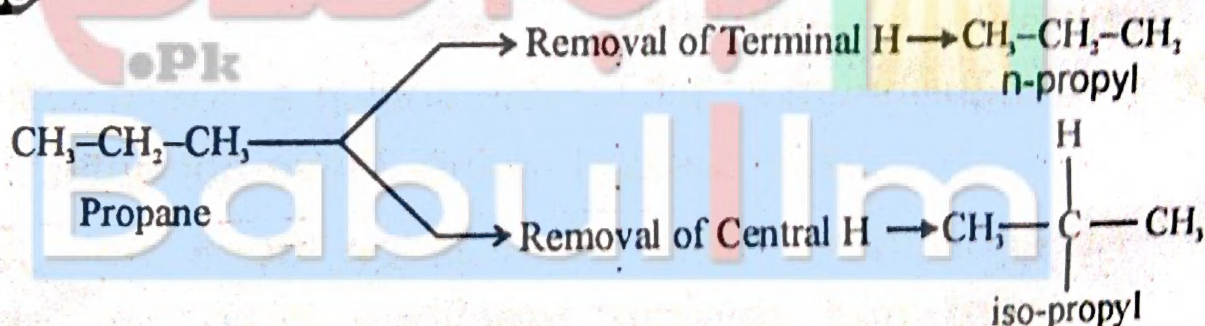
$$[OH^-] = 0.001\ M \text{ or } 10^{-3}\ M$$

$$pOH = -\log 10^{-3} = 3$$

(vi) Define organic compound.

Ans Organic compounds are hydrocarbons (compounds of carbon and hydrogen) and their derivatives, in which covalently bonded carbon is an essential constituent.

(vii) Write formulae of n-propyl and isopropyl.

Ans

(viii) Define functional group. Give one example.

Ans An atom or group of atoms or presence of double or triple bond which determines the characteristic properties of an organic compound is known as the functional group.

3. Write short answers to any Six (6) questions: 12

(i) Define unsaturated hydrocarbons. Give an example.

Ans The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons. For example:

(a) For double bond (viz alkenes)

$H_2C = CH_2$ — Ethene $\qquad$ $H_3C - CH = CH_2$ — Propene

(b) For triple bond (viz alkynes)

$HC \equiv CH$ — Ethyne $\qquad$ $H_3C - C \equiv CH$ — Propyne

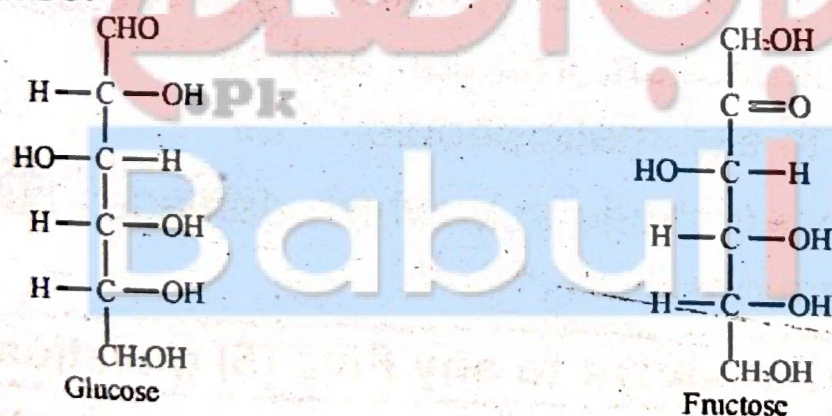
(ii) Write down two uses of ethene.

Ans Ethene is used:

(a) for artificial ripening of fruits.

(b) as a general anaesthetic.

(iii) What is the difference between glucose and fructose?

Ans Glucose is a pentahydroxy aldehyde while the fructose is a pentahydroxy ketone having the open chain structures:

(iv) What do you mean by genetic code of life?

Ans DNA is the permanent storage place for genetic information in the nucleus of a cell. It carries and stores all genetic informations as instructions from generation to generation how to synthesize particular proteins from amino acids. These instructions are 'genetic code of life.'

(v) Write down diseases born by the deficiency of vitamin A.

Ans Diseases born by the deficiency of vitamin A are night blindness and eye inflammation.

(vi) What is difference between ghee and oil?

Ans Ghee exists in solid form at room temperature. Ghee is also called fats. Fats are triglycerides of saturated fatty acids.

While oils exist in liquid form at room temperature. They are triglycerides of unsaturated fatty acids.

(vii) Name the two constituents of Troposphere.

Ans The major constituents of troposphere are nitrogen and oxygen gases.

(viii) What do you mean by greenhouse effect?

Ans As the concentration of CO_2 in air increases, less heat energy is lost from the surface of the earth. Thus, the average temperature of the surface gradually increases. This is called greenhouse effect.

(ix) Write down two effects of SO_2 gas.

Ans (a) SO_2 is a colourless gas having irritating smell. It causes suffocation, irritation and severe respiratory problems to asthmatic people.

(b) SO_2 forms sulphuric acid which damages buildings and vegetations.

4. Write short answers to any Five (5) questions: 10

(i) How hydrogen bonding enables water to dissolve different substances?

Ans Water molecule is composed of oxygen and hydrogen atoms.

Because of two O — H bonds and two lone pairs, one H_2O molecule can form hydrogen bonding with four other H_2O molecules, which are arranged tetrahedrally around the H_2O molecule. This unique behaviour of water enables it to dissolve many polar non-ionic compounds

having hydroxyl group (–OH), like alcohols, organic acids, glucose, sugar, etc. by forming hydrogen bonds with them.

(ii) Write causes of temporary hardness in water.

Ans Temporary hardness in water is because of presence of bicarbonates of calcium and magnesium.

(iii) Write two disadvantages of detergents.

Ans (a) Some of the detergents are non-biodegradable. When household water containing these detergents is discharged in streams, ponds, lakes and rivers, it causes water pollution.

(b) The detergent remains in the water for a long time and makes the water unfit for aquatic life.

(iv) How can we be protected by waterborne diseases?

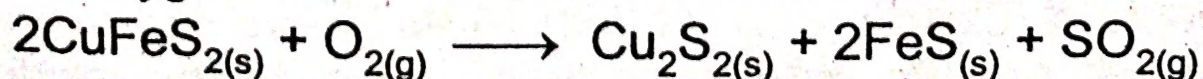
Ans (a) Drinking water must be properly treated and purified.

(b) There must be adequate sanitary disposal of savage. Any type of waste must not be thrown directly in water supplies or reservoirs.

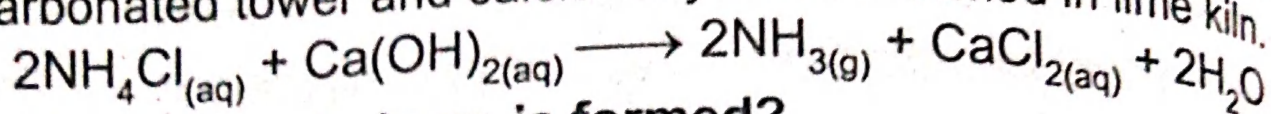
(v) How roasting is carried out?

Ans It is a process of heating the concentrated ore to a high temperature in excess of air.

For example, copper pyrite is strongly heated in excess of air to convert it into a mixture of cuprous sulphide and ferrous sulphide ($Cu_2S + FeS$). While impurities react with oxygen to form volatile oxides. Such as:

$$2CuFeS_{2(s)} + O_{2(g)} \longrightarrow Cu_2S_{2(s)} + 2FeS_{(s)} + SO_{2(g)}$$

(vi) How Ammonia is recovered in the Solvay's process?

Ans Ammonia is recovered in the carbonating tower from ammonium chloride solution produced in the carbonated tower and calcium hydroxide formed in lime kiln.

$$2NH_4Cl_{(aq)} + Ca(OH)_{2(aq)} \longrightarrow 2NH_{3(g)} + CaCl_{2(aq)} + 2H_2O$$

(vii) How petroleum is formed?

Ans Petroleum was formed by the decomposition of dead plants and animals buried under Earth's crust millions of years ago. It is believed that millions of years ago, living plants and animals in the seas died. Their bodies sank and buried under mud and sand. Then decomposition process took place in the absence of air because of high pressure, temperature and bacterial effects. This process took millions of years for completion. Thus, remains of dead plants and animals were converted into a dark brownish viscous crude oil.

(viii) Write the composition and uses of diesel oil.

Ans The composition of diesel oil is C_{13} to C_{15}. While, uses of diesel oil are: fuel for buses, trucks, railway engines, tubewell engines and other heavy vehicles.

(Part-II)

NOTE: Attempt any three (3) questions.

Q.5.(a) State the Law of mass action and derive the expression for equilibrium constant for a general reaction. (4)

Ans **Law of Mass Action:**

This law states that "The rate at which a substance reacts is directly proportional to its active mass and the rate of reaction is directly proportional to the product of active masses of the reacting substances."

Consider a general reversible reaction:

$$A + B \underset{K_r}{\overset{K_f}{\rightleftharpoons}} C + D$$

Suppose [A], [B], [C] and [D] are the molar concentrations of A, B, C and D.

Then according to the law of mass action,

Rate of forward reaction $\propto$ [A][B]

$$= K_f [A][B]$$

Similarly, rate of reverse reaction $\propto$ [C][D]

$$= K_r[C][D]$$

Where K_f and K_r are called as proportionality constants called as specific rate constants of the forward and reverse reactions, respectively.

At equilibrium state:

Rate of forward reaction = Rate of reverse reaction

$$K_f [A] [B] = K_r [C][D]$$

$$\frac{K_f}{K_r} = \frac{[C]\,[D]}{[A]\,[B]} \qquad \left[\text{where } \frac{K_f}{K_r} = K_c\right]$$

$$K_c = \frac{[C][D]}{[A]\,[B]}$$

Where 'K_c' is an equilibrium constant.

(b) Write a note on normal and acidic salts. **(3)**

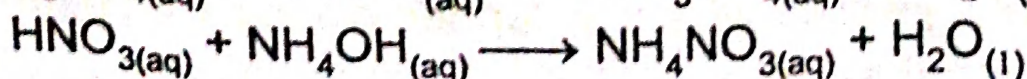
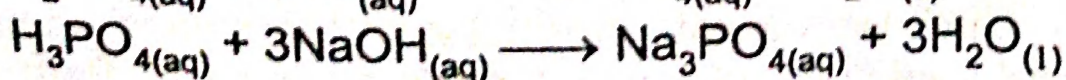
Ans **Normal salts:**

A salt formed by the total replacement of ionizable H^+ ions of an acid by a positive metal ion or NH_4^+ ions is called normal or neutral salt. These salts are neutral to litmus, that is,

$$HCl_{(aq)} + KOH_{(aq)} \longrightarrow KCl_{(aq)} + H_2O_{(l)}$$

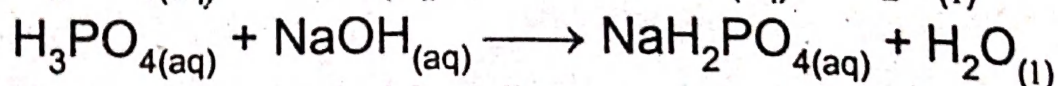
$$H_2SO_{4(aq)} + ZnO_{(aq)} \longrightarrow ZnSO_{4(aq)} + H_2O_{(l)}$$

$$H_3PO_{4(aq)} + 3NaOH_{(aq)} \longrightarrow Na_3PO_{4(aq)} + 3H_2O_{(l)}$$

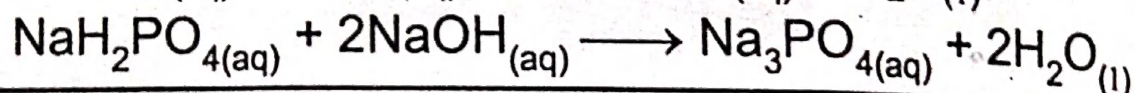
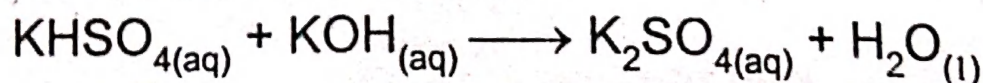
$$HNO_{3(aq)} + NH_4OH_{(aq)} \longrightarrow NH_4NO_{3(aq)} + H_2O_{(l)}$$

Acidic Salts:

These salts are formed by partial replacement of a replacable H^+ ions of an acid by a positive metal ion.

$$H_2SO_{4(aq)} + KOH_{(aq)} \longrightarrow KHSO_{4(aq)} + H_2O_{(l)}$$

$$H_3PO_{4(aq)} + NaOH_{(aq)} \longrightarrow NaH_2PO_{4(aq)} + H_2O_{(l)}$$

These salts turn blue litmus red. Acidic salts react with bases to form normal salts.

$$KHSO_{4(aq)} + KOH_{(aq)} \longrightarrow K_2SO_{4(aq)} + H_2O_{(l)}$$

$$NaH_2PO_{4(aq)} + 2NaOH_{(aq)} \longrightarrow Na_3PO_{4(aq)} + 2H_2O_{(l)}$$

Q.6.(a) Describe tests to identify carboxylic group. (4)

Ans **(i) Litmus test:**

Shake a pinch of the given compound with water and add a drop of blue litmus solution.

Result:

Litmus paper will turn red.

(ii) $NaHCO_3$ solution test:

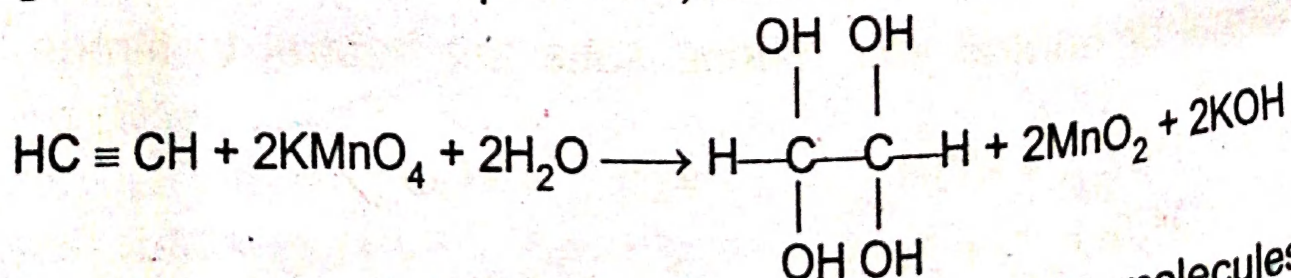
Take about 2.0 cm^3 of 5 % $NaHCO_3$ solution and add a pinch of given compound.

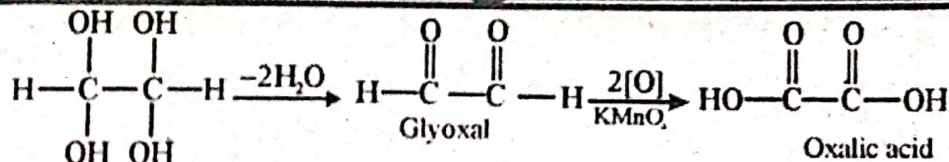
Result:

CO_2 gas with effervescence evolves.

(b) State Oxidation of alkynes with $KMnO_4$. (3)

Ans Ethyne is oxidized by $KMnO_4$, and four hydroxyl groups add to the triple bond, such as:

$$HC \equiv CH + 2KMnO_4 + 2H_2O \longrightarrow H-\underset{OH}{\overset{OH}{\underset{|}{\overset{|}{C}}}}-\underset{OH}{\overset{OH}{\underset{|}{\overset{|}{C}}}}-H + 2MnO_2 + 2KOH$$

This intermediate product eliminates water molecules to form glyoxal, which is further oxidized to form oxalic acid.

$$\underset{\text{}}{\mathrm{H-\overset{OH}{\underset{OH}{C}}-\overset{OH}{\underset{OH}{C}}-H}} \xrightarrow{-2H_2O} \underset{\text{Glyoxal}}{\mathrm{H-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-H}} \xrightarrow[KMnO_4]{2[O]} \underset{\text{Oxalic acid}}{\mathrm{HO-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-OH}}$$

Q.7.(a) Give four sources and uses of proteins. (4)

Ans (i) Meat, fish, eggs, etc. are the important sources of animal proteins. These are necessary for the synthesis of protoplasm.

(ii) Enzymes are also proteins. These catalyze the reactions occurring in the body. These are used as medicines, too. The enzymes stop the excretion of blood from the body. Moreover, these are also used in the treatment of blood cancer.

(iii) Skins of animals are proteins. These are used for the manufacturing of leather. Leather is used for making shoes etc.

(iv) Proteins are also found in bones. When the bones are heated, gelatin is formed. It is used in the manufacturing of bakery items.

(v) Beans, nuts, etc. are proteins. These are obtained from plants and used as food.

(b) Explain CO_2 is necessary for plants but its increasing concentration is alarming for us. Why? (3)

Ans **Importance of CO_2:**

CO_2 is an essential gas for plants as O_2 is essential for animals. Plants consume CO_2 in photosynthesis process and produce O_2. While animals use O_2 in respiration and give out CO_2. In this way, a natural balance exists between these essential gases as represented here.

Increasing concentration of CO_2 is dangerous:

Although CO_2 is not a poisonous gas, yet its increasing concentration due to burning of fossil fuels in different human activities is alarming. Because CO_2 in the atmosphere acts like a gas wall of a greenhouse. It allows UV radiations to pass through it but does not allow the IR radiations to pass through it. It traps some of the infrared radiations emitted by the earth. Hence, increased concentration of CO_2 layer absorbs the infrared radiations emitted by the Earth's surface that prevents heat energy escaping from the atmosphere. It helps to stop surface from cooling down during night.

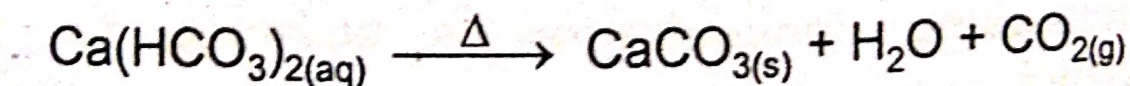
Greenhouse effect:

As the concentration of CO_2 in air increases, less heat energy is lost from the surface of the Earth. Therefore, the average temperature of the surface gradually increases. This is called greenhouse effect.

Q.8.(a) Explain the methods of removing temporary hardness of water. (4)

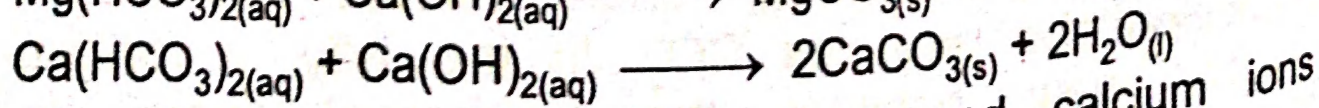
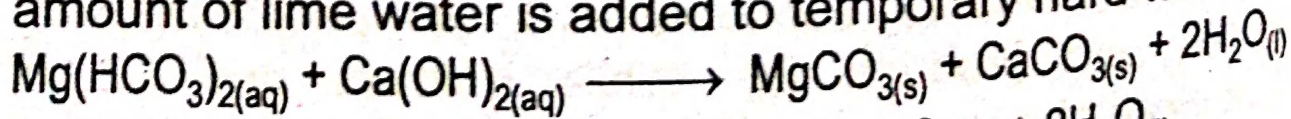
Ans **(a) By boiling:**

Temporary hardness of water is easily removed by boiling water. On boiling, calcium bicarbonate $Ca(HCO_3)_2$ decomposes to produce insoluble calcium carbonate, which precipitates out of the solution.

$$Ca(HCO_3)_{2(aq)} \xrightarrow{\Delta} CaCO_{3(s)} + H_2O + CO_{2(g)}$$

(b) Clark's method:

A chemical method to remove temporary hardness is by the addition of slaked lime $Ca(OH)_2$. A calculated amount of lime water is added to temporary hard water.

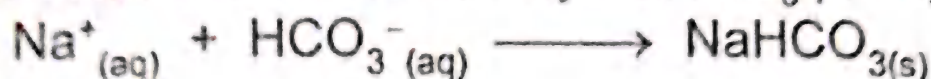
$$Mg(HCO_3)_{2(aq)} + Ca(OH)_{2(aq)} \longrightarrow MgCO_{3(s)} + CaCO_{3(s)} + 2H_2O_{(l)}$$

$$Ca(HCO_3)_{2(aq)} + Ca(OH)_{2(aq)} \longrightarrow 2CaCO_{3(s)} + 2H_2O_{(l)}$$

Thus, once the magnesium and calcium ions precipitate out, water becomes soft.

(b) What is ammoniacal brine and how its carbonation is carried out? (3)

Ans **Manufacture of Sodium Carbonate by Solvay's Process:**

Principle of Solvay's process lies in the low solubility of sodium bicarbonate at low temperature *i.e.*, at 15°C. When CO_2 is passed through an ammoniacal solution of NaCl called ammoniacal brine, only $NaHCO_3$ precipitates.

$$Na^+_{(aq)} + HCO_3^-{}_{(aq)} \longrightarrow NaHCO_{3(s)}$$

Raw Materials:

The raw materials needed for this process are cheap and easily available. They are in abundance, such as:

(i) Sodium chloride (NaCl) or brine.
(ii) Limestone ($CaCO_3$).
(iii) Ammonia gas (NH_3).

Basic Reactions:

The process consists of the following steps:

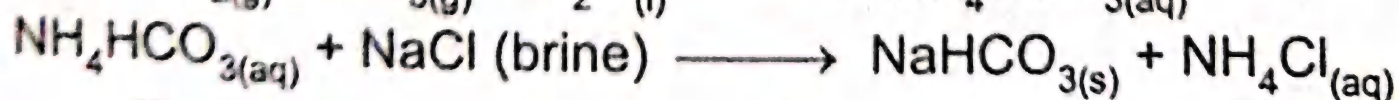
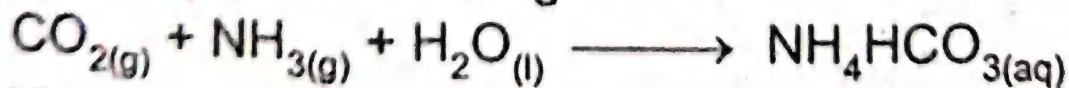
(i) Preparation of ammoniac brine:

First of all, ammoniac brine is prepared by dissolving ammonia gas in sodium chloride solution (brine).

(ii) Carbonation of ammoniac brine:

Ammoniac brine is fed into carbonating tower and carbon dioxide is passed through it. Following reactions take place in the carbonating tower:

$$CO_{2(g)} + NH_{3(g)} + H_2O_{(l)} \longrightarrow NH_4HCO_{3(aq)}$$

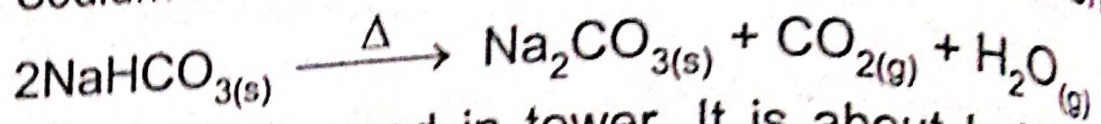
$$NH_4HCO_{3(aq)} + NaCl\ (brine) \longrightarrow NaHCO_{3(s)} + NH_4Cl_{(aq)}$$

The temperature of the mixture is lowered to 15°C and precipitates of $NaHCO_3$ are obtained.

(iii) Filtration of precipitates:

The milky solution from the carbonating tower is filtered to get sodium bicarbonate. It is used as a baking soda.

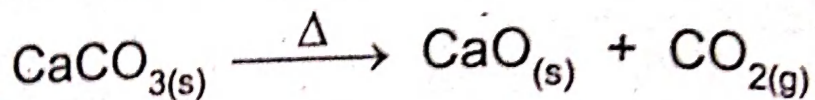
(iv) **Calcination:**

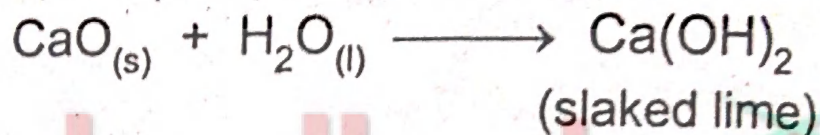
Sodium bicarbonate is heated to get sodium carbonate.

$$2NaHCO_{3(s)} \xrightarrow{\Delta} Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$$

CO_2 is again used in tower. It is about half of CO_2 needed in the process.

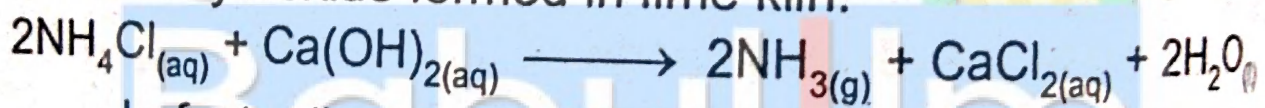
(v) **Preparation of carbon dioxide and slaked lime:**

CO_2 is prepared by heating limestone in a lime kiln. Then it is carried to carbonating tower:

$$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}$$

Quick lime (CaO) formed in lime kiln is slaked with water. Then, it is pumped to the ammonia recovery tower.

$$CaO_{(s)} + H_2O_{(l)} \longrightarrow \underset{\text{(slaked lime)}}{Ca(OH)_2}$$

(vi) **Ammonia recovery tower:**

Ammonia is recovered in this tower from ammonium chloride solution produced in the carbonated tower and calcium hydroxide formed in lime kiln.

$$2NH_4Cl_{(aq)} + Ca(OH)_{2(aq)} \longrightarrow 2NH_{3(g)} + CaCl_{2(aq)} + 2H_2O_{(l)}$$

In fact, all ammonia is recovered in this tower and is reused in the process. There are minor losses of ammonia in the process which are compensated by using some fresh ammonia.

Q.9.(a) Describe the importance of Urea. (4)

Ans **Importance and status of urea:**

Urea is a white crystalline organic compound. There are 6 units for manufacturing of urea in Pakistan.

(i) Urea is used as nitrogenous fertilizer. It contains comparatively more nitrogen than any other nitrogenous fertilizer. It is also used as additional food for animals.

(ii) It is used in the manufacturing of explosives.

(iii) It is not poisonous and flameable. Therefore, it can be stored very easily.

(iv) It is also used as raw material for the manufacturing of various other substances.

(v) It is used in automobile systems to reduce NO_2 pollutants.

(b) What is acid rain and how is it formed? (3)

Ans **Acid rain** is formed by dissolving acidic air pollutants such as sulphur dioxide and nitrogen dioxide by rainwater. Rainwater converts SO_2 into H_2SO_4 and NO_x to HNO_2 and HNO_3. Normal rainwater is weakly acidic because it consists of dissolved CO_2 of the air. Its pH is about 5.6 to 6. But rainwater on dissolving air pollutants (acids) becomes more acidic and its pH reduces to 4. Acid rain is dangerous for the life of the plants and animals. It also attacks on the calcium carbonate present in the marble and limestone of the buildings. Hence the buildings become dull and eroded day by day. Moreover, these rains increase the acidity of the soil, too. Thus the growth of plants is affected.

(Part-III)

(Practical Part)

Note: Attempt any Two (2) questions.

A-(i) Write the apparatus required to standardize the given hydrochloric acid solution. (2)

Ans Pipette, burette, funnel, conical flask, beaker.

(ii) Write the procedure to determine the molarity of given Oxalic acid $(COOH)_2 . 2H_2O$ solution. (3)

Ans **Procedure:**

1. Weigh exactly 1.26 g of oxalic acid on a watch glass with the help of a top loading balance.

2. Dissolve the above acid in about 50 cm^3 distilled water taken in a beaker.
3. Transfer the above solution to a measuring flask (100 cm^3). Wash the beaker with a small amount of water and transfer the washings to the same measuring flask.
4. Add water in the measuring flask to make up the volume up to the etched mark. Mix the solution thoroughly.
5. To find out its exact molarity, titrate it with the standard NaOH solution.
6. For this purpose, take oxalic acid solution in a burette.
7. After removing the air bubbles from the nozzle of the burette, note down the initial reading.
8. Pipette out 10 cm^3 of the given solution of NaOH in a conical flask and add two drops of phenolphthalein indicator with the help of a glass tube or a dropper. The solution turns pink.
9. Add oxalic acid solution to the alkaline solution taken in the conical flask dropwise with constant stirring. Take a rough reading following the procedure in experiment. The end point is light pink colour to colourless. Note down the final reading.
10. Repeat the titration for accurate reading by adding the oxalic acid solution to the conical flask rapidly to within 2 cm^3 of the end point and then drop by drop till the end point is reached.
11. Note down the final reading from the burette.
12. Take three concordant readings.

B-(i) Explain the procedure of experiment used to identify Aldehyde by Fehling solution. (2)

Ans **Procedure for Fehling's Test:**

(i) Mix 3 cm^3 of Fehling's solution A with 3 cm^3 of Fehling's solution B in an empty test tube.

(ii) Dissolve a few crystals of glucose in 3 cm^3 water.
(iii) Mix the two solutions.
(iv) Heat the test tube containing the above mixture.

(ii) What is the apparatus required to identify ketones using 2, 4-dinitrophenyl hydrazine test. (3)

Ans Test tubes, test tube holder, burner, water bath, match box, dropper, safety goggles.

C-(i) Write down apparatus used for the identification of saturated and un-saturated organic compounds by $KMnO_4$ test. (2)

Ans Test tubes, test tube holder, test tube rack, dropper.

(ii) Describe the procedure to demonstrate that sugar decomposes into elements and other compounds. (3)

Ans

(i) Fill about one-third of the dry test tube with sugar crystals.
(ii) Fix this test tube in a test tube holder or clamp of iron stand.
(iii) Heat the test tube gently with a Bunsen burner.
(iv) A blue flame is used for heating because it is hotter and cleaner.
(v) Bring dry cobalt chloride paper near the mouth of the test tube and observe the change in its colour.